

Radiation and Nuclear Safety Authority Regulation on Practices that Cause Exposure to Natural Radiation

Adopted in Helsinki on 28 January 2022

In accordance with a decision of the Radiation and Nuclear Safety Authority, the following provisions are issued by virtue of the Radiation Act (859/2018):

Chapter 1 General regulations

Section 1 Scope of application

This regulation applies to practices that cause exposure to natural radiation.

The regulation is not applicable to radiation exposure resulting from:

- 1) a natural radioactive substance used as a radiation source or the radioactive waste generated by it;
- 2) nuclear material or nuclear waste in the use of nuclear energy as referred to in the Nuclear Energy Act (990/1987).

Section 2 Definitions

For the purposes of this regulation:

- 1) *final treatment* means final treatment within the meaning of the Waste Act (646/2011);
- 2) *landfill* means a landfill within the meaning of the Government Decree on Landfills (331/2013);
- 3) *extractive waste disposal area* means extractive waste disposal area within the meaning of the Government Decree on Extractive Waste (190/2013);
- 4) *natural radioactive substance* means a naturally-occurring radioactive substance, such as potassium-40 as well as the uranium isotopes uranium-238 and uranium-235 as well as thorium isotope thorium-232 and the radioactive substances generated as a result of their radioactive decay;
- 5) *construction product* means a construction product as referred to in Regulation (EU) No. 305/2011 of the European Parliament and of the Council, laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, and a construction product referred to in the Act on the Type Approval of Certain Construction Products (954/2012);
- 6) *normal workplace* means a workplace with ventilation and temperature, moisture, and other physical properties corresponding to the indoor properties of normal buildings;
- 7) *measurement period* means the period of time between the start and end of the measurement;

Council Directive 2013/59/Euratom (32013L0059); OJEU L 13, 17.1.2014, p. 1
Reported to the Commission in accordance with Article 33 of the Treaty establishing the European Atomic Energy Community.

- 8) *determination period* means the period of time between two separately indicated times for which the radon concentration, radon exposure and radiation dose is determined;
- 9) *continuous measurement* means continuous measurement or a measurement over certain integration times which is used for investigating the temporal variation of radon concentration.

Chapter 2

Notifications to the Radiation and Nuclear Safety Authority prior to the commencement of a practice

Section 3

Notification on the practice

The notification referred to in section 145 of the Radiation Act must specify or provide, in terms of the practices referred to in subsection 1, paragraphs 1–3:

- 1) the employer and the undertaking responsible for the practice;
- 2) the location and address of the practice;
- 3) which practice referred to in section 145 of the Radiation Act is in question;
- 4) the quantities of the materials and waste referred to in section 145, subsection 1, paragraph 3 of the Radiation Act as well as their activity concentrations;
- 5) a general description of the practice;
- 6) the schedule of the practice;
- 7) the schedule for the waste management of the materials and waste containing radioactive substances;
- 8) an account of the quantity and quality of the materials, waste and discharges resulting from the practice and containing natural radioactive substances as well as of their possible reuse, recycling, utilization, final treatment, and placement in an excavation waste disposal area;
- 9) the schedule for the possible construction work following the extraction work.

In terms of the practice of aviation, the notification must specify or provide:

- 1) the party engaged in aviation;
- 2) the employer/employers/air carrier;
- 3) the most common flight routes and altitudes as well as aircraft types;
- 4) a general description of the practice;
- 5) an estimate on the number of radiation workers;
- 6) an estimate of the doses received by the radiation workers and the grounds for the estimation.

Chapter 3

Mining, the excavation of rocks as well as other utilization of soil, rock and other materials

Section 4

Chapter's scope of application

This chapter provides for any practice referred to in section 145, subsection 1, points 1 and 3 and section 151 of the Radiation Act which utilizes soil, rock or other materials occurring in nature or the materials resulting from the use of these materials, including mining and the excavation of rocks.

Section 5

Investigating radiation exposure arising from the practice

Radiation exposure is determined by assessing occupational and public exposure, including potential exposure, during and after the operation. The long-term public exposure after the end of the practice shall also be assessed. These investigations shall be carried out before the start of the practice.

The assessment must account for the exposure caused by both external radiation and any radioactive substances entering the body, except for indoor radon. The assessment must account for the planned measures for limiting the exposure.

However, the occupational exposure need not be assessed if, through measurements or investigations, it has been demonstrated that the activity concentrations of natural radioactive substances in the materials processed are no higher than the clearance level at different stages of the processing and the activity concentration of caesium-137 does not exceed 5 becquerels per gram.

However, the public exposure during the operation need not be assessed if, through measurements or investigations, it has been demonstrated that for the materials handled in the operation

- 1) the activity concentrations of natural radioactive substances are no higher than the clearance level;
- 2) the activity concentration of caesium-137 does not exceed 1 becquerel per gram; and
- 3) the public exposure resulting from the discharges of natural radioactive effluents into the aquatic environment is no higher than the limit value for a minor discharge.

However, the public exposure after the end of the practice need not be assessed if it is demonstrated by measurements or investigations that the activity concentrations of the waste remaining on the site of the practice and disposed of there or elsewhere do not exceed the levels specified in subsection 4, paragraph 1 and 2, and the requirement of subsection 3 is also met in the long term after the end of the practice and the final treatment operations.

Section 6

Investigation of public exposure arising from ash

The public exposure arising from ash resulting from the combustion of peat, coal and wood materials need not be assessed in the manner provided for in section 5, subsections 1 or 2 if

- 1) the ash is used for civil engineering and its activity concentrations meet the condition for civil engineering construction products referred to in section 13, subsection 3, paragraphs 2 and 3; or
- 2) the ash is used as forest fertilizer up to a maximum of 10 tonnes per hectare over a period of 20 years and the activity concentration of the ash meets the condition:

$$C_{Th-x}/4 + C_{U-x} + C_K/100 + C_{Cs}/8 \leq 1;$$

where C_{Th-x} is the highest activity concentration of the radionuclides thorium-232, radium-228 and thorium-228, C_{U-x} is the highest activity concentration of the radionuclides uranium-238, radium-226 and lead-210, and C_K and C_{Cs} are the activity concentrations of potassium-40 and caesium-137; all activity concentrations are in units of becquerel per gram; or

- 3) the ash is placed in a landfill and the activity concentrations of the ash are at or below the clearance level and the activity concentration of caesium-137 is at or below 1 becquerel per gram.

Section 7 Notification of the results of the investigation

The notification of the results of the investigation referred to in section 146, subsection 4 of the Radiation Act shall detail the information specified in section 3, subsection 1 of this regulation. However, the information does not need to be notified again if it has already been notified as required and the information has not changed.

The notification must also include:

- 1) the performer of the investigation;
- 2) details of the radionuclides and exposure pathways relevant to the radiation exposure as well as the key criteria for assessing the exposure;
- 3) an estimate of the radiation doses received by the workers and the number of workers exposed to radiation;
- 4) an estimate of the radiation doses received by members of the public and the number of people exposed to radiation;
- 5) the measures limiting radiation exposure which have been accounted for when assessing the occupational or public exposure.

Section 8 Limit values for minor discharges

The limit value for a minor discharge as referred to in section 127, subsection 1 of the Radiation Act in the effective dose to members of the public from radioactive substances discharged into waterways in the processing of soil, rock, or other materials is 0.1 mSv a year.

The limit value for a minor discharge in the effective dose received by members of the public outside the place of a practice due to radioactive substances other than radon discharged into the open air is 10 μ Sv a year.

The limit value for a minor discharge in the annual average radon concentration caused by radon that is discharged into the open air outside the place of a practice is 10 Bq/m³.

Section 9 Discharges and the plan concerning their monitoring

The plan concerning the discharges of radioactive substances referred to in section 127, subsection 2 of the Radiation Act shall detail:

- 1) the grounds for the necessity of the discharge;
- 2) the dose constraint of members of the public, justifications included;
- 3) procedures for monitoring the discharges and the resulting exposure to members of the public;
- 4) the limit values for the discharges, justifications included.

Section 10 Delivery of information concerning discharges and their monitoring

The notification referred to in section 127, subsection 4 of the Radiation Act shall detail the nuclide-specific total quantity and temporal variation of the discharges. The notification must be delivered every three months, always by the end of the month following each quarter.

Section 11 Baseline environmental radioactivity study

The scope of the investigations referred to in section 128, subsection 2 of the Radiation Act, radiation measurements, and the determinations of radioactive substances shall account for the characteristic features of the practice and the operating environment.

The investigations must include, as applicable, radiation measurements and the determinations of radioactive substances in terms of:

- 1) external radiation;
- 2) the radon in outdoor air;
- 3) other radioactive substances in outdoor air;
- 4) the soil;
- 5) household water;
- 6) groundwater;
- 7) the aquatic environment;
- 8) minor forest produce and game;
- 9) foodstuffs and grazing grass.

The measurements and determinations must be carried out during two different seasons.

The detection limits of measurements of radiation and radioactive substances as well as the accuracies of the determinations must be such as to allow the reliable verification of radiation exposure at a level equal to the reference level.

Section 12 Monitoring public exposure resulting from the discharges

Assessments concerning the radiation dose of members of the public resulting from the discharges generated by the processing of soil, rock, and other materials shall account for the exposure resulting from the direct radiation of the discharges and the internal exposure resulting from them.

The determination of the dose shall also account for the dose caused by radioactive substances accumulating in the environment when the practice continues for a long time.

The monitoring of public exposure resulting from discharges shall be regular and systematic to allow for the detection of the impact on public exposure of any short and long-term changes in the quantities of radioactive substances accumulating in the environment.

The measurements and determinations of radioactive substances related to the monitoring of public exposure shall be carried out in such a way that the results can be reliably compared against the results of the baseline environmental radioactivity study.

Chapter 4 Construction products

Section 13 Investigating public exposure arising from construction products

The public exposure arising from a construction product is calculated from the activity concentrations of radium-226, thorium-232, and potassium-40 in the construction product in its intended purpose of use. If the construction product also includes cesium-137 or some other artificial radioactive substance which generates gamma radiation, the radiation exposure resulting from it must be accounted for when determining the total radiation exposure.

If the activity concentration of cesium-137 in concrete intended for construction of buildings is higher than 50 Bq/kg, the radiation exposure resulting from it must also be determined separately.

However, the investigation referred to above in subsection 1 need not be carried out if

- 1) the activity concentrations of the construction product intended for the construction of buildings meet the condition:

$$C_{Th}/200 + C_{Ra}/300 + C_K/3,000 \leq 1;$$

- 2) the activity concentrations of the construction product intended for the construction of streets, roads, and yards meet the condition:

$$C_{Th}/500 + C_{Ra}/700 + C_K/8,000 + C_{Cs}/2,000 \leq 1;$$

- 3) the activity concentrations of the construction product intended for earthworks other than those referred to in paragraph 2 meet the condition:

$$C_{Th}/1,500 + C_{Ra}/2,000 + C_K/20,000 + C_{Cs}/5,000 \leq 1;$$

where C_{Th} , C_{Ra} , C_K and C_{Cs} are the activity concentrations of the thorium-232, radium-226, potassium-40, and cesium-137 contained in the construction product in the units Bq/kg.

Section 14

Notification on the results of investigations concerning radiation exposure caused by a construction product

Notification on the results of investigations concerning the radiation exposure caused by a construction product shall specify:

- 1) the party responsible for the investigation referred to in section 153 of the Radiation Act;
- 2) the author of the investigation;
- 3) the construction product and its intended purpose of use;
- 4) the radioactive substances in the construction products, their activity concentrations, and determination methods;
- 5) an estimate of the public exposure;
- 6) a description of the calculation method used in the determination of the dose and of the key assessment criteria.

However, the information referred to above in subsection 1, paragraphs 5 and 6 need not be specified if the condition pursuant to the construction product's intended purpose of use as referred to in section 13, subsection 3 is met. In such cases, the report must specify the calculation proving the condition's fulfilment.

Chapter 5 Radon at workplaces

Section 15

Investigating radon concentration

The investigation referred to in section 155 of the Radiation Act shall be conducted with a measurement of radon concentration lasting for at least two months in the period between the beginning of September and the end of May (measurement season). The measurement may be carried out during another period for a justified reason.

The measurement referred to above in subsection 1 can be supplemented with a separate continuous measurement of radon concentration. The measurement shall be carried out during

the measurement season and it shall last for a minimum of seven days. The determination period shall be exactly seven days, or its multiple, and it shall represent a typical working week.

If the radon concentration cannot be investigated in the manner specified in subsection 1 due to the duration or conditions of the work, the radon concentration of the workplace or the radon exposure of workers shall be investigated by some other method.

Section 16 Investigating radon exposure

In the situation referred to in section 144, subsection 3 of the Radiation Act, the radon exposure of a worker shall be:

- 1) measured with a radon exposure measurement approved for the purpose, which allows for determining the radon exposure during working hours over the determination period; or
- 2) determined with the help of the workplace's radon concentration measurements and the records of working hours in the manner referred to in section 21.

Section 17 Test report

A test report compliant with a Finnish or international standard must be prepared of the measurement referred to above in section 15, subsections 1 - 3 and in section 16, subsection 1, paragraph 1.

In addition, the test report on the measurement referred to above in section 15, subsection 2 shall specify:

- 1) the average radon concentration at the measurement point over the determination period;
- 2) the average radon concentration during working hours at the measurement point over the determination period;
- 3) the determination period's dates and hours for which the average radon concentration during working hours has been calculated;
- 4) the serial number of the continuous measuring device used in the measurement;
- 5) a diagram of the radon concentration and the original list of results from the measurement period.

The test report on the measurement referred to above in section 15, subsection 3 must include information corresponding to the information provided on the measurement referred to in section 15, subsection 1.

In addition, the test report on the measurement referred to above in section 16, subsection 1 shall specify:

- 1) information on any background deduction made;
- 2) the result of the background measurement and the resulting uncertainty in the result.

Section 18 Measurement points and numbers

At normal workplaces, radon measurements must be conducted in each separate building and in each working area served by a separate ventilation machine as follows, at the minimum:

- 1) one measurement, if the area is no greater than 100 square metres;
- 2) two measurements, if the area is greater than 100 square metres.

If the area is greater than 200 square metres, at least one measurement for every 200 square metres or part thereof must also be conducted or, in a continuous open space, at least one measurement for every 3,000 square metres or part thereof must be conducted.

In underground mines and excavation sites as well as in tunnels, the location and number of the measurement points must be such that the results provide the basis for a reliable estimate of the workplace's radon concentration.

Section 19 Regular measurements

The radon concentration of an underground excavation site must be measured every six months. However, the interval between the measurements can be a year if the result of two consecutive measurements at all measurement points is lower than 100 Bq/m³.

The radon concentration of an underground mine must be measured every other year. However, the interval between the measurements can be five years if the result of three consecutive measurements at all measurement points is lower than 100 Bq/m³.

This section is not applied to practices in which workers' radiation dose is determined regularly as referred to in section 24.

Section 20 Calculation of annual average radon concentration at normal workplaces

Annual average radon concentration (C_{RV}) at normal workplaces is calculated by multiplying the result of the radon measurement referred to in section 15, subsection 1 (c_p) by 0.9. The radon concentration's annual average can be used as an estimate for the annual average of the radon concentration during working hours.

If the measurement referred to in section 15, subsection 2 has been conducted, a more precise estimate for the annual average of the radon concentration during working hours (C_{TRV}) at normal workplaces is calculated as follows:

$$C_{TRV} = \frac{C_{TK}}{C_{VK}} \times C_{RV}$$

where

C_{TK} is the average radon concentration during working hours over the determination period (seven days, or its multiple) and C_{VK} is the average radon concentration during the determination period.

Section 21 Determining radon exposure by radon concentration measurements

To assess a worker's exposure to radon, by radon concentration measurements, the radon concentrations in different workspaces must be investigated in such a way that a reliable estimate on the radon exposure is obtained. If the workspace is located on the second floor, which is located entirely or primarily above ground or on a floor above this, the radon concentration does not need to be measured, but can be assumed to be 40 Bq/m³.

A worker's occupational exposure to radon (*radon exposure, B*) is calculated as follows:

$$B = \sum_{i=1}^n C_i T_i = C_1 T_1 + C_2 T_2 + \dots + C_n T_n,$$

where C_i is the radon concentration in the workspace i , T_i is the time spent in the space in question, and n is the number of different workspaces.

Section 22 Notifying the results of the investigation

The notification referred to in Section 146, subsection 4 of the Radiation Act on the measurement of a workplace's radon concentration or a worker's exposure to radon shall provide the test report referred to in Section 17 and the information specified in Annex 1.

Section 23 Limiting radiation exposure

The measures aiming to limit radiation exposure resulting from a workplace's radon must be taken without delay.

The adequacy of the measures must be verified with measurements or calculations equivalent to those that established that the radon concentration or radon exposure was greater than the reference level. The results of the measurements must be reported to the Radiation and Nuclear Safety Authority in the manner specified in section 22.

Section 24 Determination of radiation dose and delivering information to the workers' dose register

The radiation dose received by a worker in the situations referred to in section 149, subsection 3 and section 155, subsection 4 of the Radiation Act must be determined on the basis of three-month measurement periods or a measurement from the working period, if the working period is shorter than three months. The measurement periods must be timed in a such a way that the dose resulting from the radon per each calendar year can be determined.

The information on workers' radiation doses and radon exposure as well as on the doses' other key calculation criteria must be delivered to the workers' dose register in the manner specified by the Radiation and Nuclear Safety Authority within a month of the end of the determination period.

Chapter 6 Aircraft crew

Section 25 Determining radiation exposure

The maximum determination period for the radiation exposure of an aircraft crew is a calendar year.

The radiation exposure shall be determined as an effective dose.

The radiation exposure shall be determined with a validated calculation method suitable for the purpose. The validation shall be carried out according to international standards or in a documented manner otherwise suitable for it. The calculated ambient dose equivalent/ambient dose equivalent rate may not deviate from the measured or reference value by more than $\pm 30\%$.

Flying at an altitude greater than 15 km requires the use of measuring equipment with which the workers' radiation dose can be determined.

Section 26 Delivering information to the dose register

The radiation dose data of an aircraft crew must be delivered to the workers' dose register within a month of the end of the determination period.

Section 27
Entry into force and transitional provision

This regulation enters into force on 15 February 2022 and is valid until further notice.

This regulation applies to any matters pending on the date of its entry into force.

This regulation repeals the Radiation and Nuclear Safety Authority's Regulation on Practices that Cause Exposure to Natural Radiation (STUK S/3/2019).

In Helsinki on 28 January 2022

Director General Petteri Tiippana

Director Tommi Toivonen

Availability of the regulation, guidance and advice

This regulation has been published as part of the regulations issued by the Radiation and Nuclear Safety Authority (STUK) and it is available from the Radiation and Nuclear Safety Authority.

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ANNEX 1**Information to be notified on the measurement of radon concentration in a workplace or radon exposure of a worker**

1. The following must be notified in terms of measurements referred to in section 15:
 - a) the name and address of the measurement site;
 - b) the name and address of the employer;
 - c) the individual names of the measuring points;
 - d) the name of the measurer and the measurement method;
 - e) the start and end date of the measurement;
 - f) the result of the measurement.

2. If the result of the measurement referred to in section 15, subsection 1 or 3 is greater than the reference level, then in addition to the information in paragraph 1, the information in paragraph 1 shall be supplemented by the following:
 - a) the total number of workers at the measurement site concerned;
 - b) the area of the first floor which is wholly or mainly above ground level;
 - c) the area of underground work and break rooms and social rooms;
 - d) the data of the measuring point; the floor of the building where the measuring point is located, the number of workers and the working hours per year, according to the person working the most;
 - e) whether there is periodic mechanical ventilation at measuring point;
 - f) whether the measuring point is other premise used by people referred to in the Health Protection Act.

3. For the measurement referred to in section 15, subsection 2, the information in paragraph 1 shall be supplemented by the following:
 - a) the settings of the ventilation cycling during the time-of-work measurement and during the previous radon can measurement;
 - b) whether the ventilation has been adjusted since the previous radon measurement;
 - c) what measures have been taken to reduce the radon concentration since the previous measurement.

4. In the case of a radon exposure measurement as referred to in section 16, subsection 1, the information in paragraph 1 shall be supplemented by the following:
 - a) the operating principle of the ventilation in the room where the measuring instruments are kept outside working hours;
 - b) the procedures for monitoring the use and storage of the instruments.

5. If the radon exposure of a worker has been determined in the manner referred to in section 20, the information in paragraph 1 shall be supplemented by the following:
 - a) calculations in accordance with section 21 and a summary of the results thereof;
 - b) the measurements used in the calculations.
 - c) what measurements have been used in the calculations.